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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/644,738	08/21/2003	Tsuyoshi Nakamura	2003_1187A	6204

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WASHINGTON, DC 20006-1021

EXAMINER
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YOUNG, CHRISTOPHER G

ART UNIT	PAPER NUMBER
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1756

DATE MAILED: 06/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

**Application No.**

10/644,738

**Applicant(s)**

NAKAMURA ET AL.

**Examiner**

Christopher G. Young

**Art Unit**

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 21 August 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-5 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
  - Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

2. Claims 1-3 and 5 are rejected under 35 U.S.C. 102(e) as being anticipated by Chun, US Patent Number 6,486,058.

The instant application is drawn to a method of forming fine patterns comprising: covering a substrate having photo resist patterns thereon made of a photo resist composition which is sensitive to high energy light rays with wavelength of 200 nm or shorter or electron beam radiation, with an over-coating agent for forming fine patterns, applying heat treatment to cause thermal shrinkage of the over-coating agent so that the spacing between adjacent photo resist patterns is lessened by the resulting thermal shrinking action, and removing the over-coating agent substantially completely.

Chun discloses a method of forming a photoresist pattern defining a contact hole. A photoresist pattern that defines an opening there through is provided over a semiconductor substrate surface. Then, a layer of water-soluble organic over-coating material (WASOOM) is coated over the photoresist pattern including the opening thereof. Next, the resulting structure is flowed to shrink the size of the opening. After the resist reflow, WASOOM is removed. Thus, using the methods of the present invention, a photoresist pattern capable of forming a 0.18  $\mu\text{m}$  (and below) contact hole can be formed using an inexpensive conventional optical lithography system. Further, because WASOOM is water-soluble, WASOOM can be substantially completely removed from the photoresist pattern using a simple cleaning process, i.e., water rinse, after baking for resist reflow. Thus, the process steps are simplified and the problems such as the difficulty in CD control and the environmental issues are avoided. Referring to FIG. 3, an insulating layer 22 is formed on the surface of semiconductor substrate 24. Next, to form a photoresist pattern defining a contact hole, a photoresist layer 26, for example, an i-line, KrF or ArF

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photoresist layer is formed on the insulating layer 22. Then, the photoresist layer 26 is selectively exposed through a photomask (not shown). The exposure of photoresist layer 26 can be performed by ultraviolet (UV) light, i-line, deep UV (D-UV), extreme-UV (E-UV), e-beam, or x-ray. Further, the photoresist layer 26 is developed to form a photoresist pattern 26' using a developing solution such as one containing 2.38 tetramethylammonium hydride (TMAH). As a result, a photoresist pattern 26' that defines an opening 28 therethrough is provided over the insulating layer 22.

Subsequently, a resist-reflow buffer layer 30 is coated over the photoresist pattern 26' including the opening 28 thereof to fill the opening. The resist-reflow buffer layer 30 is preferably coated to a thickness of approximately 2000 .ANG. as indicated by dimension T in FIG. 3. In the present invention, the resist-reflow buffer layer 30 is formed of a water-soluble organic over-coating material (WASOOM).

Following the coating of WASOOM, the resulting structure is resist-reflowed to shrink the size of the opening 28. The resist reflow is performed by heat treatment techniques, e.g., baking. This step of baking for contact hole shrinking is preferably performed at a temperature of approximately 50-200.degree. C. More preferably, the baking for contact hole shrinking is performed at a temperature of approximately 150-170.degree. C. Most preferably, the baking is performed at 165.degree. C. because it is discovered that there is no iso-dense bias at that temperature. Also, the baking is preferably performed for less than approximately five minutes.

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After the resist reflow, WASOOM is removed. Particularly, WASOOM can be almost completely removed by rinsing the resulting structure with a hydrophilic developing solution. Thus, substantially no undesirable reactants are left on the side walls of the photoresist pattern 26". Preferably, the hydrophilic solution can be D1 water, TMAH-containing solution, alkyl alcohol, or mixtures thereof.

Chun clearly describes, teaches and suggests the claimed embodiments of claims 1-3 and 5. The claim 5 embodiment of temperature restriction to prevent thermal fluidizing of the photoresist is inherent since the prior art reference teaches temperature ranges that are within those disclosed in the instant application's specification (see page 15 of the application specification).

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chun, US Patent Number 6,486,058.

A description of the application claims, and of the reference in general is set forth above. The Examiner incorporates all comments presented in the rejection above

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herein. Claim 4 is drawn to a specific range of solids content based on mass% for the over-coating agent.

It is held that it is not inventive to discover the optimum or workable ranges of result-effective variables by routine experimentation. In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). See also In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have determined the optimum values of the relevant concentration parameters (including those of claim 4) in Chun through routine experimentation in the absence of a showing of criticality.

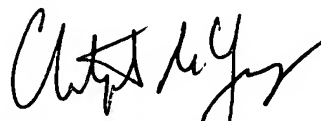
### ***Conclusion***

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher G. Young whose telephone number is 571-272-1394. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Christopher G. Young  
Primary Examiner  
Art Unit 1756

cgy